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$2(180^\circ - AmB - Bmy)]$ we get Ag. Then in $\triangle\ gAC$ are given gA, AC, and $\angle gAC\ (= gAe + eAB - BAC)$ to find gC and $\angle AgC$. And then in isosceles $\triangle\ gkC$ we have gC and $\angle\ gkC\ [= 2(180^\circ - gyC)]$ and hence all the angles, to determine $gk\ (= kC)$. Now in $\triangle\ kge$ are known kg, ge and $\angle kge\ (= kgC + Age - AgC)$ to get ke and $< gek$.

In $\triangle\ ked$ we know de, ek and $< dek\ (= 360^\circ - gek - ged)$ and hence all the angles and side dk. And in $\triangle\ dky$ we have all the sides and hence all the angles. In $\triangle\ yke$ are known ke, ky and $< eky\ (= dky + dke)$ to find ey. Then in $\triangle\ Aey$ having ey, Ae and $< Aey\ (= 360^\circ - yek - gek + Aeg)$ we find Ay. And in $\triangle\ ABy$ are known Ay, AB and observed $< AyB$ to get yB and $< yAB$. Now in $\triangle\ CAy$ we have Ay, AC and $< yAC\ (= yAB - BAC)$ to find $< AyC$. Then since $< Aym = Cym - AyC$, and the $< yAm = 180^\circ - Bmy - BmA - Aym$, we have in the $\triangle\ mAB$ known the $< mAB\ (= yAB + yAm)$, the side AB, and the $< AmB$ to find Am and Bm.

Geom. Const.:—Through A and B lay down circles of position containing respectively the angles AmB and AyB. Then from AB at A lay off $< BAg = Bmy$ and at B the $< ABg = 180^\circ - AmB - Bmy$, and g the point of intersection of the two lines thus drawn will be a secant point of the circle ABm and the right line through m and y. Now through g and C sweep a circle of position containing the observed angle gyC, and y, a secand point of this and the position circle ABy, is one of the required places of observation (an approximate knowledge of his position will in general tell the observer whether he was at y or x); then draw the right line yg and m the point where it cuts the circle ABm is the other place of observation.

A more general statement of the Rule given at page 146, vol. I, of the ANALYST, for plotting the centre of a circle of position is: — At each end of the line, joining the two observed signals, lay off the difference between the observed angle and 90°, on the same side of this line as the place of observation if the observed angle is less than 90°, but if greater than 90°, on the opposite side. And if the observed angle = 90° then the centre of the position circle is at the middle point of the line joining the signals.

SOLUTION OF PROBLEM 94. (*SEE PAGE* 199, *VOL. II.*)

BY PROF. W. W. BEMAN, ANN ARBOR, MICH.

FROM the figure we easily obtain,

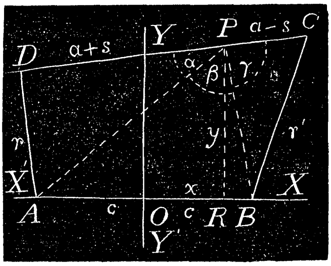
$$\cos a = \frac{y^2 + (c + x)^2 + (a + s)^2 - r^2}{2(a + s)\sqrt{[y^2 + (c + x)^2]}}, \quad \ldots\ldots\ldots \quad (1)$$

$$\cos\beta = \frac{y^2 + (c+x)^2 + y^2 + (c-x)^2 - 4c^2}{2\sqrt{[y^2 + (c+x)^2]}\sqrt{[y^2 + (c-x)^2]}} = \frac{y^2 + x^2 - c^2}{\sqrt{[y^2+(c+x)^2]}\sqrt{[y^2+(c-x)^2]}} \quad \ldots\ldots (2)$$

$$\cos\gamma = \frac{y^2 + (c-x)^2 + (a-s)^2 - r'^2}{2(a-s)\sqrt{[y^2 + (c-x)^2]}} \quad \ldots\ldots\ldots (3)$$

Now since $\alpha + \beta + \gamma = 180°$, we have

$$2\cos\alpha\cos\beta\cos\gamma + \cos^2\alpha + \cos^2\beta + \cos^2\gamma - 1 = 0. \quad \ldots\ldots (4)$$



Substituting in (4) the values of $\cos\alpha$, $\cos\beta$, and $\cos\gamma$, as given in (1), (2) and (3), we get: $2(a^2 - s^2)(y^2 + x^2 - c^2)[y^2 + (c+x)^2 + (a+s)^2 - r^2][y^2 + (c-x)^2 + (a-s)^2 - r'^2] + (a-s)^2[y^2 + (c-x)^2][y^2 + (c+x)^2 + (a+s)^2 - r^2]^2 + (a+s)^2[y^2 + (c+x)^2][y^2 + (c-x)^2 + (a-s)^2 - r'^2]^2 + 4(a^2 - s^2)^2(y^2 + x^2 - c^2)^2 - 4(a^2 - s^2)^2[y^2 + (c+x)^2][y^2 + (c-x)^2] = 0$. By a laborious reduction we finally obtain:

$$4a^2(x^2 + y^2)^3 - 8acsx(x^2 + y^2)^2 + 4[2a^2(a^2 - s^2) + c^2(2a^2 + s^2) - ar^2(a-s) - ar'^2(a+s)](x^2 + y^2)^2 - 16a^2c^2x^2(x^2 + y^2) + 4[(a^2 - s^2)(r^2 - r'^2 - 4as) - 4asc^2]cx(x^2 + y^2) + 16asc^3x^3 + \{[2a(a^2 - s^2) - r^2(a-s) - r'^2(a+s)]^2 - 4c^2[2(a^2 - s^2)^2 + r^2(a-s)^2 + r'^2(a+s)^2 - (a^2 + 2s^2)c^2]\}(x^2 + y^2) + 8c^2[r^2(a-s)^2 + r'^2(a+s)^2 - 2s^2c^2]x^2 + 2c[2(a^2 - s^2)(r^2 - r'^2)(a^2 - s^2 - c^2) - r^4(a-s)^2 + r'^4(a+s)^2 - 4as(a^2 - s^2 - c^2)^2]x + c^2[r^2(a-s) - r'^2(a+s) - 2s(a^2 - s^2 - c^2)]^2 = 0,$$

which is the equation of the locus of *any* point in the line DC.

When P is the *middle* point, we have merely to make $s = 0$ in our equation, giving:

$$4(x^2 + y^2)^3 + 4(2a^2 - 2c^2 - r^2 - r'^2)x^4 + 4(2a^2 + 2c^2 - r^2 - r'^2)y^4 + 8(2a^2 - r^2 - r'^2)x^2y^2 + 4c(r^2 - r'^2)x(x^2 + y^2) + (2a^2 - 2c^2 - r^2 - r'^2)^2x^2 + [(2a^2 + 2c^2 - r^2 - r'^2)^2 - 16a^2c^2]y^2 + 2c(2a^2 - 2c^2 - r^2 - r'^2)(r^2 - r'^2)x + c^2(r^2 - r'^2)^2 = 0.$$

The terms in the last equation are arranged somewhat differently, in order to show the symmetry of the coefficients.

[The solution of this problem as published in No. 1, p. 28, contains an error in reduction in the equation given in line 3 on said page, which vitiates all the subsequent part of the solution and consequently the conclusion.]

Remark. — Though we dissent from some of the conclusions arrived at by Mr. Adcock in the following solution of 89, yet as Mr. Siverly himself has come to the conclusion that the published solution is defective, we publish Mr. Adcock's solution, hopingthat it will elicit a fuller discussion.–Ed.